

EXECUTIVE SUMMARY

The objectives of this study were to obtain field and experimental information needed to formally speciate and characterize the general ecology of a newly discovered toxic estuarine dinoflagellate, and to examine its significance in causing fish kills in the Neuse and Pamlico Estuaries. Removal of the outer covering membranes on the cells revealed the configuration of an "armor" of protective cellulose plates, and verified that this dinoflagellate represents a new family, genus and species. This information, together with descriptions of 15 flagellated, amoeboid and encysted stages in the complex life cycle, was used to formally name the dinoflagellate to the genus *Pfiesteria* (nov.gen., pronounced "feast-er-i-a"); it will be formally named within a new family as *Pfiesteria piscimorte* (Latin species name meaning "fish killer;" following publication of Steidinger *et al.* [in prep.]). The predominance of ubiquitous amoeboid stages in the life cycle of this alga will result in its placement within the order Dinamoebales (Division Pyrrophyta, Class Dinophyceae; Burkholder *et al.* 1992, Steidinger *et al.* in prep.).

In 1991 - 1992 *Pfiesteria piscimorte* (nov.gen., nov.sp.) was the causative agent of at least one-third of the major fish kills in the Neuse and Pamlico Estuaries. The alga is stimulated by fresh fish excreta, and it is lethal to all 18 species of native and exotic finfish and shellfish tested. Preliminary observations suggest that sublethal toxin exposure may also cause long-term damage to epidermal, neural, immune and reproductive systems of affected fish. The toxic flagellated vegetative stage (or dinospore) of *P. piscimorte* (nov.gen., nov.sp.) is lethal across broad temperature, salinity and light gradients. Field data from our monitoring program and State records document toxicity at temperatures ranging from 4-30°C, with most outbreaks occurring at 26°C or higher. Based on field and laboratory data, this dinoflagellate is capable of killing fish at salinities ranging from 2-35‰, with an optimum salinity for toxic outbreaks at 15‰. *P. piscimorte* (nov.gen., nov.sp.) is also lethal to fish in freshwater (~0‰) with high divalent cation content (alkalinity \geq ~20 mg/L). Moreover, it is toxic to fish at available light ranging from 0.2 $\mu\text{Einst m}^{-2} \text{sec}^{-1}$ (darkness for all but several minutes per 24-hr period) to 200 $\mu\text{Einst m}^{-2} \text{sec}^{-1}$ (12 hr of light and 12 hr of darkness per 24-hr period), with no apparent preference in light availability.